Joint WK#12: Microelectronics: Materials, Design, Devices, and Characterizations

Organizers: Yuzi Liu, Hua Zhou, and Yue Cao

Novel materials and design to break the limit of current semiconductor devices are urged in order to meet the increasing requirement in microelectronics in beyond Moore's computing era. The emerging concept of stacktronics attracts great interests in research communities in recent years due to the unique properties of various 2D materials and the approach of stacking which could be implemented for device fabrications in large scale. The concept of neuromorphic computing has created a new paradigm of energy efficient infrastructures and unique computing approach has caught great attention in the last decade. A suite of promising materials and devices were reported and demonstrated the great potentials for applications. However, there are still many critical questions regarding fundamental material properties, innovative device design, device working mechanism and reliability. The architecture-level understanding and the integration of the new microelectronics devices with existing semiconductor technologies remain much less explored. The efficiency and effectiveness of the new proof-of-concept devices rely on fundamental understanding of material transformation while the device in operation. It urgently calls for operando observation and microscopic characterization in different length scales.

This workshop will discuss widely what state of art of microelectronics design and fabrications, the emerging proof-of-concept devices and performance evaluation, the high throughput characterization platforms and computational tools available and in needs at national facilities, including the cross platform *operando* imaging capabilities (synchrotron x-ray and electron beam) to tackle the fundamental challenges in capturing material evolution in working devices. The workshop will gather the experts in fields of inverse design, materials and device fabrication and evaluation, condensed matter physics and characterizations to discuss the opportunities to move forward in the field of microelectronics.